
CLAIMS

[Claim(s)]
[Claim 1] It is a fuse whenever [45 - 55 % of the weight / of Bi(s) /, and alloy mold temperature / which is characterized by using the alloy of a presentation of Remainder In as a fuse element].
[Claim 2] It is a fuse whenever [alloy mold temperature / which is characterized by using as a fuse element the alloy of the presentation which carried out 0.5-5 weight section addition of Ag at 45 - 55 % of the weight of Bi(s), and the 100 weight sections of a presentation of Remainder In].
[Claim 3] A fuse element is a fuse whenever [according to claim 1 or 2 alloy mold temperature / with the cross-section round shape below 600 micrometers of wire sizes phi, or un-circular it and this cross section].

[Translation done.]

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2002-150906

(43)Date of publication of application : 24.05.2002

(51)Int.Cl. H01H 37/76
C22C 12/00
C22C 28/00

(21)Application number : 2000-340486

(22)Date of filing : 08.11.2000

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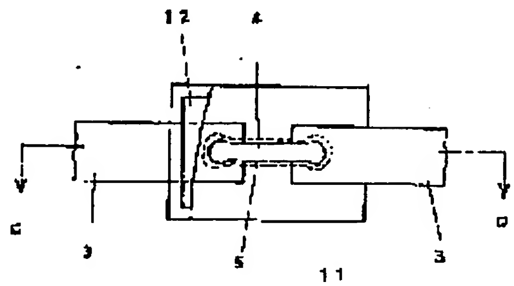
(54) ALLOY-TYPE THERMAL FUSE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an alloy-type thermal fuse that can be operated with an superior precision, even in the thinner wire trend of the fuse element at operating temperature of 85°C-95°C and that is suitable for environmental protection.

SOLUTION: An alloy having a composition of Bi 45-55 wt.% and the rest In is used as a fuse element.



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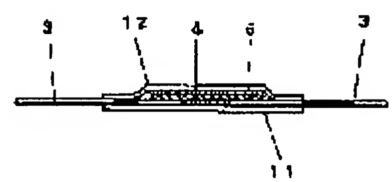

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LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

TECHNICAL FIELD

[Field of the Invention] This inventions are a fuse and a thing concerning [a fuse element diameter] a fuse at 85 degrees C - 95 degrees C in operating temperature especially whenever [below 600 micrometerphi / alloy mold temperature] whenever [alloy mold temperature].

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] Environmental preservation is suited, in order to eliminate the incorrect actuation by self-generation of heat well, to be able to intercept energization of a device at the predetermined temperature of 85-95-degree-C class and not to use a heavy metal harmful to living bodies, such as Pb, Cd, Hg, and Tl, according to the fuse whenever [concerning this invention / alloy mold temperature], even if the diameter of a fuse element is the narrow diameter 300micrometerphi. Therefore, it is [whenever / thin alloy mold temperature / of an operating temperature the class of 90 degrees C] very useful as a fuse.

[Translation done.]

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2.**** shows the word which can not be translated.
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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This inventions are a fuse and a thing concerning [a fuse element diameter] a fuse at 85 degrees C - 95 degrees C in operating temperature especially whenever [below 600 micrometerphi / alloy mold temperature] whenever [alloy mold temperature].
[0002]
[Description of the Prior Art] A fuse connects the piece of a low-melt point point fusible alloy (fuse element) to the lead wire of a pair, or inter-electrode whenever [alloy mold temperature]. If flux is applied to low-melt point point fusible alloy Kataue, and it is the configuration which closed this piece of a fluxing alloy in resin or a case, and is used, attaching in the electrical machinery and apparatus which should be protected and an electrical machinery and apparatus carries out abnormality generation of heat The piece of a low-melt point point fusible alloy is liquid-phase-ized by melting with the generating heat, and it spheroidizes with surface tension under coexistence with the flux which the molten metal already fused, it is divided by advance of balling-up, and the energization to a device is intercepted.
[0003] One of the conditions required of the piece of a low-melt point point fusible alloy of a fuse whenever [above-mentioned alloy mold temperature] is that solid-liquid coexistence **** between the solidus line of the melting point and the liquidus line is narrow. Namely, in an alloy, solid-liquid coexistence **** exists between the solidus line and the liquidus line, and it usually sets to this ****. In the temperature requirement (referred to as deltaT) which the above-mentioned balling-up fragmentation may occur since it is in the condition that solid phase grain distributed and also has the liquid phase's property into the liquid phase, and belongs to solid-liquid coexistence **** before liquidus-line temperature (this temperature is made into T') Balling-up fragmentation of the piece of a low-melt point point fusible alloy may be carried out. It ** and must be dealt with as what operates in the temperature requirement where fuse element temperature becomes -(T' - deltaT) T' in the thermal fuse using this piece of a low-melt point point fusible alloy, therefore a thermal fuse may be correctly operated with predetermined laying temperature by making variation in the actuation temperature requirement of a thermal fuse into smallness, so that solid-liquid coexistence **** is so narrow that deltaT is smallness.
[0004] These days, the fuse is demanded by diversification of electronic equipment whenever [alloy with an operating temperature of 85 degrees C - 95 degrees C mold temperature]. Moreover, corresponding to the miniaturization of electronic equipment, a miniaturization or thin-shape-izing of a fuse is required whenever [alloy mold temperature], for example, use of the thin line fuse element 300micrometerphi is demanded. Conventionally, the low-melt point point solder which uses Bi, Pb, Sn, In, Hg, Tl, etc. as a component is known as solder used for soldering of a semi-conductor with heat-resistant low temperature. For example, the Bi-Pb-Cd alloy (52 % of the weight of Bi(s), 40 % of the weight of Pb(s), 8 % of the weight of Cd(s)) of 92-degree-C ******, the In-Sn-Cd alloy (44 % of the weight of In(s), 42 % of the weight of Sn, 14 % of the weight of Cd(s)) of 93-degree-C ******, etc. are well-known as low-temperature solder which has a solid-liquid coexistence region before and after 90

degrees C, and has the width of the field in the range permissible on actuation of a thermal fuse.
[0005]
[Problem(s) to be Solved by the Invention] However, these low-melt point point solder contains the metal harmful to living bodies, such as Cd and Pb, and cannot respond to environmental preservation regulation of late. Moreover, with the Bi-Pb-Cd alloy of 92-degree-C eutectic with which Bi occupies most, it is brittle, and since drawing is difficult, the miniaturization or thin-shape-izing of a thermal fuse by thinning of a fuse element is difficult. Furthermore, in soldering, although it can be coped with by adjustment of the cross-section dimension of the soldering section etc. even if the specific resistance of solder is high, in a fuse, the high specific resistance of a fuse element invites fault like the next whenever [operating temperature / of 85 degrees C - 95 degrees C /, and alloy mold temperature / of the thin line fuse element use 300micrometerphi].
[0006] that is, in soldering, it is shown in drawing 2 -- as -- the electric resistance of per current path unit length deltaL -- the soldering section F and a conductor -- E -- it is -- etc. -- the conditions for [to spread] carrying out -- the cross section of the soldering section -- the specific resistance of As and solder -- the cross section of rhos and a conductor -- the specific resistance of Aw and a conductor -- rhow then rhowdelta L/Aw=rhosdelta L/As, therefore [Equation 1]
Aw=Asrhow/rhos (1)
Come out and it is, and the difference in specific resistance can be compensated by adjusting the soldering cross section Aw so that a formula (1) may be filled. However, when r and heat dissipation resistance are set to H and an outside temperature is set [the specific resistance of a fuse element] to T0 for the radius of rho and a fuse element whenever [alloy mold temperature] in the case of a fuse, the fuse element temperature T is T-T0**rhoi2H/(pir2), therefore [Equation 2] at the time of usual [under the load current i] at the time of usual.
T=rho i2Hk/(pir2)+T0 (2)
When it comes out, and it is (k is a constant) and the melting point of a fuse element is set to Ta, in the case of rho= 0, to operating by the temperature rise of (Ta-T0), it will operate by the temperature rise of [Ta-(rhoi2 Hk)/(pir2)-T0], and, in the case of rho!=0, will operate at temperature only with rhoi2Hk/(pir2) lower than original operating temperature. **(ing), the operating temperature relative error eta is eta=[Ta-(rhoi2 Hk)/(pir2)] / Ta, therefore [Equation 3].
eta=1-(rhoi2 Hk)/(pir2Ta) (3)
Come out, when it is small (300 micrometers or less), operating temperature Ta is low (85 degrees C - 95 degrees C) and the specific resistance rho of a fuse element has the high radius r of a fuse element, the operating temperature relative error eta becomes large, and it becomes impossible to grasp and to guarantee actuation precision, and a problem is large.
[0007] The purpose of this invention is 85 degrees C - 95 degrees C in operating temperature, and is to offer a fuse whenever [alloy mold temperature / which suited the environmental preservation which may be operated in the precision which was excellent also under thinning of a fuse element].
[0008]
[Means for Solving the Problem]

MEANS

[Means for Solving the Problem] Whenever [concerning this invention / alloy mold temperature], fuses are 45 - 55 % of the weight of Bi(s), and a configuration characterized by using the alloy of a presentation of Remainder In as a fuse element, and can also carry out 0.5-5 weight section addition of Ag to said alloy presentation 100 weight section.
[0009]
[Embodiment of the Invention] The fuse element of the thermal fuse concerning this invention is manufactured by drawing of an alloy base material, and the circular line more than 200 micrometerphi or the un-circular line of the same cross section as the circular line concerned, for example, a flat line, can be preferably used for it with under the outer diameter phi of 500 micrometers more than 100 micrometerphi under with the outer diameter phi of 600 micrometers.
[0010] the alloy presentation of this fuse element -- 45 - 55 % of the weight of Bi(s), and Remainder In -- they are 48 - 52 % of the weight of Bi(s), and Remainder In preferably. The criteria presentation is 51 % of the weight of In(s), and 49 % of the weight of Bi(s), 89 degrees C and solid-liquid coexistence **** of the liquidus-line temperature of the criteria presentation are 3 degrees C, and specific resistance is 55microomegacm.
[0011] Although it becomes brittle according to increase of the addition of Bi although Above In and Bi is the typical components of low-temperature solder and the melting point can be made low by addition of Bi, and addition of another side and In can raise toughness, it is known that the melting point will fall according to increase of the addition of In. In this invention, the reason which limited Bi to 45 - 55% of the weight therefore, and limited In to 55 - 45% of the weight is for holding down the specific resistance of a fuse element to the low resistance below 60microomegacm extent while giving the ductility which makes the melting point about 90 degrees C, and makes operating temperature of a fuse 85 degrees C - 95 degrees C whenever [alloy mold temperature], and enables drawing of the fuse element of under the outer diameter phi of 600 micrometers. Usually, the operating temperature of a fuse turns into temperature higher about 2 degrees C than the melting point of a fuse element whenever [alloy mold temperature], and the melting point of the above-mentioned fuse element takes this point into consideration, and is set up.
[0012] furthermore, the above-mentioned alloy presentation 100 weight section -- Ag -- 0.5 - 5 weight section -- specific resistance is preferably mitigable from 55microomegacm to 45microomegacm 3 and by carrying out 5 weight sections addition by said twist's also being able to make specific resistance still lower, for example, carrying out 3 weight sections addition of Ag at 100 weight of 51 % of the weight of In(s), and 49 % of the weight of Bi(s).
[0013] The flat-surface explanatory view showing a fuse whenever [thin alloy mold temperature / which (b) of drawing 1 requires for this invention], Conductors 3 and 3 are fixed by adhesives or welding. the Law RO sectional view [in / in (b) of drawing 1 / (b) of drawing 1] -- it is -- plus CHIKKUBE-SUFIRUMU 11 with a thickness of 100-300 micrometers -- a band-like lead with a thickness of 100-200 micrometers -- The fuse element 4 of 300 micrometers of wire sizes phi is connected preferably 500 micrometers under of wire sizes phi in between. a band-like lead -- a

conductor -- Flux 5 is applied to this fuse element 4, and it has closed by fixing according this fluxing fuse element to the adhesives or welding of the plastic hinged cover film 12 with a thickness of 100-300 micrometers.

[0014] A fuse can be carried out also with the gestalt of a case mold, a substrate mold, or a resin dipping mold whenever [alloy mold temperature / of this invention]. The fuse element of a piece is welded. between the lead wire which counters by the straight line mutually as a case mold -- a line -- Apply flux on a fuse element and a ceramic cylinder is inserted in on this fluxing fuse element. The axial type which closed between each edge of this cylinder, and each lead wire with adhesives, for example, an epoxy resin, The fuse element of a piece is welded. or the tip between parallel lead wire -- a line -- Flux is applied on a fuse element, a ceramic cap is put for **** on this fluxing fuse element, and the radial type which closed between opening of this cap and lead wire with the epoxy resin can be used. Moreover, it can also consider as a substrate mold fuse with resistance.

[0015] The radial type which prepared the epoxy resin enveloping layer by the immersion to epoxy resin liquid on the fluxing fuse element as the above-mentioned resin dipping mold can be used.

[0016] the inter-electrode tip of the insulating substrate which prepared the stratified electrode of a pair in one side as the above-mentioned substrate mold -- a line -- the fuse element of a piece is welded, flux is applied on a fuse element, lead wire is connected to the back end of each electrode, what prepared the epoxy resin enveloping layer on insulating-substrate one side can be used, and axial **** is made to any method of a radial.

[0017] What has the melting point lower than the melting point of a fuse element is usually used for the above-mentioned flux, for example, rosin 90 - 60 weight sections, stearin acid 10 - 40 weight sections, and an activator 0 - 3 weight sections can be used for it. In this case, natural rosin, denaturation rosin (for example, hydrogenation rosin, disproportionation rosin, polymerization rosin), or these purification rosin can be used for rosin, and a hydrochloride, hydrobromate, etc. of diethylamine can be used for an activator.

[Translation done.]

EXAMPLE

[Example] [Example 1] In:51 % of the weight and Bi:49% of the weight of the alloy presentation was used. 89 degrees C and solid-liquid coexistence **** of the liquidus-line temperature of this alloy are 3 degrees C. A line was drawn and the base material of this alloy presentation was processed into the line with a diameter [phi] of 300 micrometers. Although the reduction of area about one dice was made into 6.5% and the drawing rate was made into 45 m/min, there was no open circuit. It was 55microomegacm when the specific resistance of this line was measured. This line was cut in die length of 4mm, it considered as the fuse element, and the fuse was produced whenever [substrate mold temperature]. The presentation of the rosin 80 weight section, the stearin acid 20 weight section, and the diethylamine hydrobromate 1 weight section was used for flux, and the epoxy resin of room temperature setting was used for resin material.
[0019] When it was immersed in the programming-rate oil bath for /of 1 degree C and the oil temperature at the time of the energization cutoff by fusing was measured about these 50 example articles, energizing a 0.1A current, it was within the limits of 90**1 degree C. Moreover, it was able to hold down to the small value of extent which can disregard the operating temperature relative error eta which is within the limits of 89**1 degree C, and was evaluated by said formula (3) about 50 example articles when it was immersed in the programming-rate oil bath for /of 1 degree C and the oil temperature at the time of the energization cutoff by fusing was measured, energizing a 2A current.
[0020] [Example 2] The alloy presentation which carried out 3 weight sections addition of Ag was used for the alloy presentation 100 weight section of an example 1. 88 degrees C and solid-liquid coexistence **** of the liquidus-line temperature of this alloy are 3 degrees C. When a line was drawn like the example 1 and the base material of this alloy presentation was processed into the line with a diameter [phi] of 300 micrometers, there was no open circuit. It was 45microomegacm when the specific resistance of this line was measured. This line was cut in die length of 4mm, it considered as the fuse element, and the fuse was produced whenever [substrate mold temperature] like the example 1.
[0021] When it was immersed in the programming-rate oil bath for /of 1 degree C and the oil temperature at the time of the energization cutoff by fusing was measured like the example 1 about these 50 example articles, energizing a 0.1A current, it was within the limits of 88**1 degree C. Moreover, it was able to hold down to the small value of extent which can disregard the operating temperature relative error eta which is within the limits of 89**1 degree C, and was evaluated by said formula (3) about 50 example articles like the example 1 when it was immersed in the programming-rate oil bath for /of 1 degree C and the oil temperature at the time of the energization cutoff by fusing was measured, energizing a 2A current.
[0022] [Example 1 of a comparison] Although drawing conditions were eased further, the reduction of area about one dice was made into 5.0% and the drawing rate was made into 20 m/min since open circuits occurred frequently, although 52 % of the weight of Bi(s), 40 % of the weight of Pb(s), and 8 % of the weight of Cd(s) were used for the low-melt point point fusible alloy and drawing to the thin line of 300 micrometerphi was tried like an example 1 or 2, open circuits occurred frequently. Then, it was processed into the thin line with a diameter [phi] of 300 micrometers by the rotating-drum type

spinning method. The specific resistance of this line was 61microomegacm. When it was immersed in the programming-rate oil bath for /of 1 degree C and the oil temperature at the time of the energization cutoff by fusing was measured, having created the fuse whenever [substrate mold temperature] like the example 1 by having used this thin line as the fuse element, and energizing a 0.1A current, many things which are not melted even if it amounts to 92 degrees C of the melting point existed. By this presentation, a thick oxide film is formed in a fuse element front face for a rotating-drum type spinning method, and this is presumed to be because for this oxide film to serve as a sheath and for a fuse element to become is hard to be melted.

[0023] [Example 2 of a comparison] In:58 % of the weight and Bi:42% of the weight of the alloy presentation was used. This alloy was processed into the line with a diameter [phi] of 300 micrometers like the example 1, and the fuse was produced whenever [substrate mold temperature]. When it was immersed in the programming-rate oil bath for /of 1 degree C and the oil temperature at the time of the energization cutoff by fusing was measured, energizing a 0.1A current as well as an example 1 about these 50 example articles of a comparison, it was within the limits of 82**7 degrees C, and BARAKKI was size. In addition, since BARAKKI of the oil temperature at the time of energization cutoff was size, it was difficult to evaluate effectively the operating temperature relative error eta by said formula (3).

[0024] [Example 3 of a comparison] In:42 % of the weight and Bi:58% of the weight of the alloy presentation was used. Although drawing to a thin line with a diameter [phi] of 300 micrometers was tried like the example 1, since open circuits occurred this alloy frequently, drawing conditions were eased further, the reduction of area about one dice was made into 5.0%, the drawing rate drawing rate 20, it was processed, and the fuse was produced whenever [substrate mold temperature]. [m/min / 20] [the thin line of **] When it was immersed in the programming-rate oil bath for /of 1 degree C and the oil temperature at the time of the energization cutoff by fusing was measured, energizing a 0.1A current as well as an example 1 about these 50 example articles of a comparison, it was within the limits of 96**7 degrees C. In addition, since BARAKKI of the oil temperature at the time of energization cutoff was size, it was difficult to evaluate effectively the operating temperature relative error eta by said formula (3).

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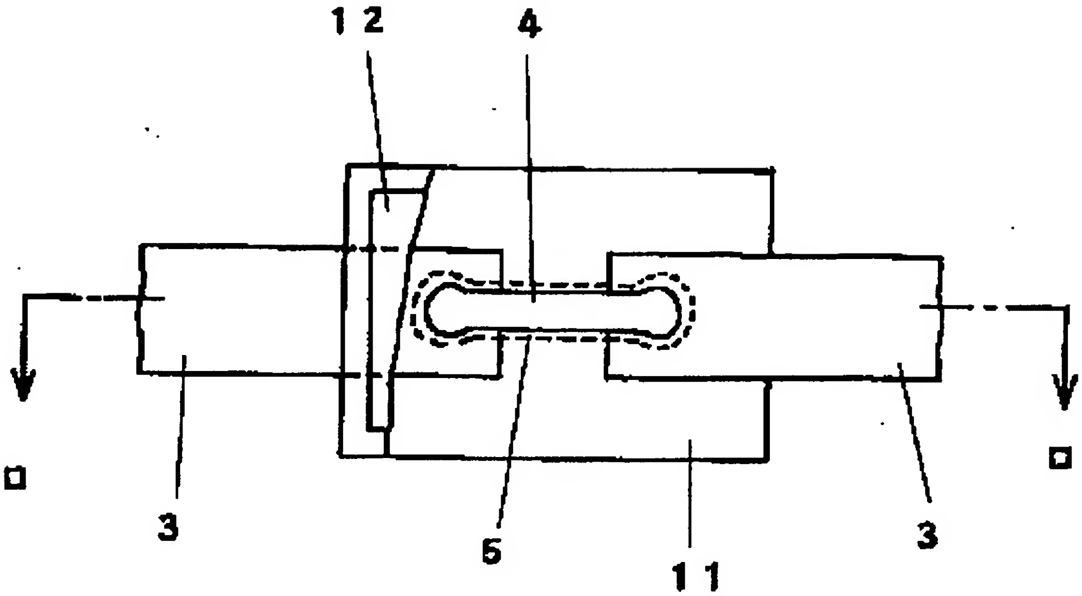

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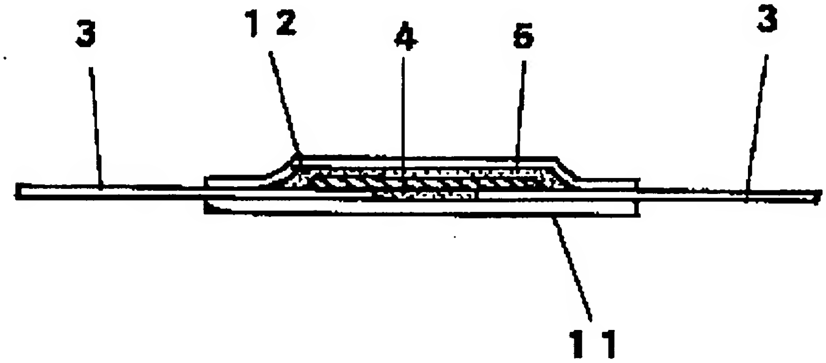

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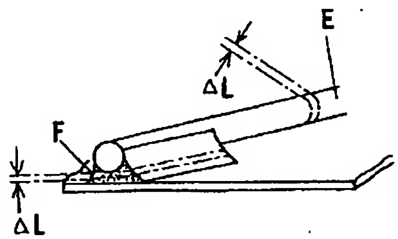

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